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Materiel Test Procedure 9-2-145  
General Equipment Test Activity

U.S. ARMY TEST AND EVALUATION COMMAND  
COMMODITY ENGINEERING TEST PROCEDURE

LIQUID TRANSPORTING AND DISPENSING EQUIPMENT

1. OBJECTIVE

This document provides test methodology and testing techniques to determine the technical performance and safety characteristics of liquid transporting and dispensing equipment and associated tools and equipment as described in Materiel Need (MN) and to determine the item suitability for service tests.

2. BACKGROUND

Increased mechanization and the concept of mobile warfare dictate that in the future there will be a considerable increase in the consumption of petroleum products by our armed forces. Bulk handling of flammable liquids and petroleum products necessitate the availability of bulk carriers and dispensing equipment.

Bulk carriers may be general purpose military cargo vehicles converted into refuelers for servicing other military vehicles and aircraft through the installation of steel or aluminum tanks or self-supporting collapsible tanks. Another form of bulk carrier is the rolling liquid transporter. This transporter consists of two fuel cell wheels mounted on a single axle capable of being filled with liquid by pumping and of being emptied by compressed air. Any prime mover that is equipped with a standard pintle hook, standard service and emergency air coupling, and suitable electrical receptacle can be used to tow the liquid transporter.

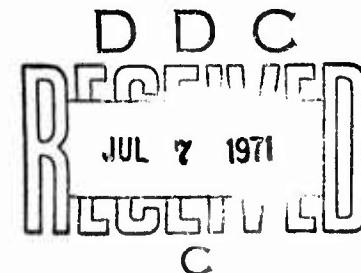
Dispensing equipment used in conjunction with the bulk carriers includes the following:

- a. Pump and power unit.
- b. Filter/separator.
- c. Manifold.
- d. Hose reels.
- e. Ground reel.
- f. Metering unit.
- g. Hose and fittings.
- h. Nozzles
- i. Valves.
- j. Tiedown equipment.
- k. Grounding rods
- l. Fuel tanks

3. REQUIRED EQUIPMENT

- a. Steel measuring tape (100 feet long).

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- b. Stopwatch.
- c. Photographic equipment.
- d. Suitable scales for weighing the test item and its shipping container.
- e. Thermometer(s)/pressure gauges.
- f. Blanks, .22 caliber, yellow powder.
- g. Detonator, 3 barrel, brake applications.
- h. Odometer with speed indicator.
- i. Tire pressure gauge (where appropriate).
- j. Tachometer.
- k. EMI instruments and antennas per MIL-STD-461.
- l. Suitable tanks and containers.
- m. Fuel testing equipment and/or facilities (refer to TM 10-1158).
- n. Thermocouples and associated readout equipment for use in monitoring bearing, pump gland, engine cooling and/or other appropriate temperatures.
- o. Fluid flowmeter(s) (positive displacement type).
- p. Adequate supply of suitable fluids for pumping.
- q. Appropriate test site(s).
- r. Maintenance and lubrication facilities.
- s. Appropriate materials handling equipment (MHE) including where appropriate, tank truck(s), and towing vehicles.
- t. Appropriate transportation capabilities and facilities.
- u. Climatic test chamber(s) and/or facilities.
- v. Rain test facilities.
- w. Impactograph.
- x. L.A.B. package testing machine.

4.

REFERENCES

- A. USATECOM Regulation 70-23 Research and Development: Equipment Performance Reports (EPRs).
- B. USATECOM Regulation 385-6 Safety: Verification of Safety of Materiel During Testing.
- C. MIL-STD-129 Marking for Shipment and Storage.
- D. MIL-STD-209 Slinging Eyes and Attachments of Lifting and Tying Down Military Equipment.
- E. MIL-STD-461 Electromagnetic Interference Requirements for Equipment.
- F. MIL-STD-462 Electromagnetic Interference Characteristics, Measurement of.
- G. MIL-STD-463 Definitions and Systems of Units - Electromagnetic Interference Technology.
- H. MIL-STD-810 Environmental Test Methods.
- I. MIL-STD-1186 Cushioning, Anchoring, Bracing, Blocking, and Waterproofing, and Appropriate Test Methods.
- J. MTP 2-2-085 Trailers.
- K. MTP 2-2-100 Trucks.
- L. MTP 2-2-601 Electrical Systems (Automotive).
- M. MTP 2-2-608 Braking, Wheeled Vehicles.

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- N. MTP 2-2-613 Broadband Radio Interference Tests of Vehicles and Electrical Equipment, Noncombatant.
- O. MTP 2-2-701 Fuels and Lubricants.
- P. MTP 2-2-704 Tires.
- Q. MTP 2-2-800 Center of Gravity.
- R. MTP 4-2-818 Testing for Fungus Resistance.
- S. MTP 9-2-155 Motors, Electrical.
- T. MTP 9-2-166 Air Compressor.
- U. MTP 9-2-181 Pump Centrifugal.
- V. MTP 9-2-182 Pump Reciprocating.
- W. MTP 9-2-183 Pumping Assembly, Flammable Liquid, Bulk Transfer.
- X. MTP 9-2-235 Tanks, Petroleum Liquid Storage, Fabric, Collapsible.
- Y. MTP 9-2-236 Tanks, Liquid Storage, Metal.
- Z. MTP 9-2-299 Hoselines (POL).
- AA. MTP 9-2-300 Manifolds for Pipelines.
- AB. MTP 9-2-301 POL Sterilization Equipment.
- AC. MTP 9-2-302 Pipeline Cleaning Equipment.
- AD. MTP 9-2-503 Durability.
- AE. MTP 9-4-001 Desert Environmental Test of Construction, Support and Service Equipment.
- AF. MTP 9-4-003 Tropic Environmental Test of Construction, Support and Service Equipment.
- AG. MTP 9-4-005 Arctic Environmental Test of Support and Service Equipment.
- AH. MTP 10-2-500 Physical Characteristics.
- AI. MTP 10-2-501 Operator Training and Familiarization.
- AJ. MTP 10-2-503 Transportability.
- AK. MTP 10-2-505 Human Factors Evaluation.
- AL. MTP 10-2-507 Maintenance Evaluation.
- AM. MTP 10-2-508 Safety.
- AN. MTP 10-2-511 Quality Assurance.
- AO. MTP 10-2-512 Reliability.
- AP. TM 10-1101 Petroleum Handling Equipment and Operations.

## 5. SCOPE

### 5.1 SUMMARY

This procedure describes the methods of evaluating the technical performance and safety characteristics of liquid transporting and dispensing equipment. To assess the degree of conformance with required standards and established criteria, the test item should be subjected to the following:

- a. Preparation for Test - A pretest inspection to determine the condition of the test item and its associated package upon arrival at the test site. This includes determination of the test item physical characteristics, operator training and familiarization program, operational check and functional verification.

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b. Operational Performance - An evaluation to examine specific operational design characteristics including the ability of the test item to perform its primary function.

c. Environmental Tests - A series of evaluations designed to examine and measure changes in the performance and physical characteristics of the test item when it is subjected to controlled changes in environmental parameters.

d. Durability - An evaluation to determine the probability that the test item will successfully survive to its projected service life or rebuild point without experiencing a durability failure.

e. Transportability - An evaluation to determine the ability of the test item and its shipping container to withstand the forces which it will experience during normal handling and transporting.

f. Maintenance Evaluation - To determine and verify the maintenance/maintainability characteristics and requirements of the test item; an appraisal of the design and of the maintenance test package; and the calculation of indicators which express the effects of the preceding aspects.

g. Reliability - An evaluation to determine the probability that the test item will perform its intended function for a specified interval under stated conditions.

h. Safety - An evaluation to determine the safety characteristics and possible hazards of the test item.

i. Human Factors - An evaluation to determine the adequacy of the design and performance characteristics of the test item and associated equipment in terms of conformance to accepted human factors engineering design criteria.

j. Value Analysis - An evaluation directed at analyzing the primary function of the test item for the purpose of cost reduction without compromising performance, reliability, quality, maintainability or safety.

k. Quality Assurance - A review to determine and evaluate defects in material and workmanship.

## 5.2. LIMITATIONS

This materiel test procedure is intended as a guide in preparing test plans for liquid transporting and dispensing equipment.

It is assumed that all components and subsystems have been previously tested and found suitable for use with petroleum products. Based on this assumption, procedures as outlined herein are intended to evaluate the test item and subsystems as a total system.

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6. PROCEDURES

6.1 PREPARATION FOR TEST

NOTE: Prepare an Equipment Performance Report in accordance with USATECOM Regulation 70-23 for any items that are missing, damaged or considered inadequate when completing the following procedures:

6.1.1 Initial Inspection

Refer to applicable procedures of MTP 10-2-500.

6.1.2 Inventory Check

Conduct an inventory verification with the Basic Issue Item List (BIIL). Record evidence of the following:

- a. Missing maintenance literature or draft technical manuals.
- b. Shortages in repair parts, accessories, or tools.
- c. Missing components.

6.1.3 Physical Characteristics

Perform the applicable procedures of MTP 10-2-500; record data as follows:

- a. Manufacturer and model, type/class.

- 1) Tanks.
- 2) Pump and power unit.
- 3) Filter/separator.
- 4) Manifold.
- 5) Hose reels.
- 6) Ground reel.
- 7) Metering unit.
- 8) Hose and fittings.
- 9) Nozzles.
- 10) Valves.
- 11) Tiedown equipment.
- 12) Grounding rods
- 13) Fuel tanks

- b. Safety equipment supplied.

- c. Weight and overall dimensions of test item(s).

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- d. Tiedowns, number and location.

6.1.4 Operator Training and Familiarization

Refer to applicable procedures of MTP 10-2-501.

6.1.5 Preoperational Inspection, Assembly, and Functional Check

Procedures as outlined in this section are intended to accomplish the following:

a. Ensure that all items removed for shipment are reinstalled and that the test item is complete in all respects.

b. Detect, prior to the accomplishment of testing procedures, any condition of the test item, its attachments or accessories, which constitutes a potential hazard to personnel, the test item, or the test facilities.

c. Detect, repair, or adjust defects, malfunctions, or conditions of the test item which would alter its operational characteristics such that the test data taken would not be representative of the commodity item.

d. Determine that the test item is safe, operable and otherwise ready for testing.

6.1.5.1 Inspection and Assembly

Review the draft technical manual(s) and other literature and instructional material as furnished with the test item; observe the procedures and precautions as listed therein and proceed as follows:

a. Ensure that all preservatives and protective materials have been removed.

b. Refer to the draft technical manual(s) and accomplish the specified post arrival assembly and installation of components and accessories, including reinstallation of those items which were removed for the purpose of shipment.

c. Accomplish the following and record any faults, failures, malfunctions, or discrepancies.

- 1) Check thoroughly for physical damage, missing parts, and loose connections.
- 2) Manipulate all controls and check for proper operation and adjustment.
- 3) Record the presence and adequacy of name plates, warning plates, and instruction plates.

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#### 6.1.5.2 Operational Check and Functional Verification

Ensure that the test item is operational. Proceed as follows:

a. Refer to the draft technical manual(s) and accomplish all preoperational maintenance and service.

b. Record the following:

- 1) Any condition of excessive vibration.
- 2) Satisfactory operation.
- 3) Adequacy of the draft technical manual(s) and other instructional material.
- 4) Any fault, malfunction, failure, or discrepancy observed.
- 5) Test item suitable for further testing.

#### 6.1.6 Components and Subsystems

As previously stated under "Limitations", Section 5.2 of this document, it is assumed that basic components and subsystems as comprise the test item have been previously evaluated and verified satisfactory for military use.

The following component and subsystem tests are given for the purpose of providing general background and reference material for use by the test activity and testing personnel.

##### 6.1.6.1 Trailer Evaluation

Refer to the applicable procedures of MTP 2-2-085.

##### 6.1.6.2 Tires and Brakes (where appropriate)

Refer to the applicable procedures of MTP 2-2-608 and MTP 2-2-704.

##### 6.1.6.3 Motors, Generators, and Electrical Systems

Refer to the applicable procedures of MTP 2-2-601 and MTP 9-2-155.

##### 6.1.6.4 Pump - Centrifugal

Refer to MTP 9-2-181.

##### 6.1.6.5 Pump - Reciprocating

Refer to MTP 9-2-182.

##### 6.1.6.6 Air Compressor (where appropriate)

Refer to MTP 9-2-166.

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6.1.6.7 Fuels and Lubricants

Refer to MTP 2-2-701.

6.1.6.8 Hoselines (POL)

Refer to the applicable procedures of MTP 9-2-299.

6.1.6.9 Manifolds

Refer to the applicable procedures of MTP 9-2-300.

6.1.6.10 POL Cleaning Components

For testing and evaluation of air eliminators, filters, filter/separators, water separators and strainers consult the applicable procedures of MTP 9-2-302.

6.1.6.11 POL Sterilization Equipment

Refer to the applicable procedures of MTP 9-2-301.

6.1.6.12 Pump - Flammable Liquid, Bulk Transfer

Refer to the applicable procedures of MTP 9-2-183.

6.1.6.13 Tanks, Petroleum Liquid Storage, Fabric, Collapsible

Refer to the applicable procedures of MTP 9-2-235.

6.1.6.14 Tanks, Liquid Storage, Metal

Refer to the applicable procedures of MTP 9-2-236.

6.1.6.15 Truck Evaluation

Refer to the applicable procedures of MTP 2-2-100.

6.2 TEST CONDUCT

The testing program shall be arranged so as to determine by controlled, measured, and instrumented testing, the technical performance and safety characteristics of the test item.

NOTE: 1. All equipment malfunctions occurring during the testing procedures shall be reported in accordance with USATECOM Regulation 70-23.

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2. Prior to initiating test procedures the test officer will review and implement all safety considerations contained in Section 6.2.8.

6.2.1     Performance

Evaluate the operational and performance characteristics of the test item by subjecting it to the following procedures:

6.2.1.1   Liquid Transporting and Dispensing Equipment, Truck Mounted

a. The subsystems shall be installed into a standard military vehicle for the purpose of converting general purpose cargo vehicles into bulk transporters and refuelers for other military vehicles and aircraft.

b. Road Test

To determine the compatibility of the test item with the cargo vehicle, conduct a road test as follows:

- 1) Component tie-down equipment and recommended methods of securing the unit will be used.
- 2) Operate the test item and vehicle combination on primary highways consisting of straight sections, curves, longitudinal and side slopes. The procedures to be followed are presented in Table 1.
  - a) Operate the test item with the tank empty, half full and full.
  - b) Vehicle operations shall include all basic maneuvers and simulated emergency stops at random intervals.
  - c) Mount an impactograph on the carrier to record shock patterns for vertical, longitudinal and lateral impacts during each road test.

Table I. Roadability Test\*

Tank Loads	Truck Speeds		Stops to be Made by Braking Action Every _____ Miles as Shown Below				Transport Miles for Each Load	
			Roads		Cross-Country		Roads	Cross-Country
	Roads	Cross-Country	Normal	Sudden	Normal	Sudden		
Empty tanks	35-40	5-15	20	5	10	5	50	100
1/2-full tanks	35-40	5-15	20	5	10	5	50	100
Full tanks	35-40	5-15	20	5	10	5	50	100

\*Include 2 1/2 and 5-Ton Trucks

- 3) Repeat the operations defined in b.2) above, over unimproved and cross country terrain.
- 4) After each road test has been completed, conduct either dispensing or filling operations to meet the load conditions of tests and provide the means of determining if the transport shocks have affected the test unit mechanical and functional performance. For each road test note the following:
  - a) General description of terrain traversed and road conditions.
  - b) Total cargo weight.
  - c) Distance traveled.
  - d) Riding or trailing capabilities of test item, and location of c.g.
  - e) Controllability of vehicle combination.
  - f) Load stability.
  - g) Any indication of weld or seam failure.
  - h) Any difficulties encountered.
  - i. Result and number of braking actions.
  - j. Each pump-down operation after each phase of transport.
    - 1. Pump engine speed (RPM).
    - 2. Pump discharge pressure (PSI).
    - 3. Pump suction pressure (in.Hg.).
    - 4. Amount dispensed (gals.).
- 5) Install any component affected by the road test on the package testing machine and secure by the same methods employed for vehicle handling.

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Adjust the lab packaging testing machine to produce shock patterns by a circular synchronous motion that is comparable with the carrier produced shock patterns. Operate package testing machine until either a failure occurs or vehicle transport shock pattern at which the failure occurred has been reproduced. Determine cause of failure and required corrective action.

6.2.1.2 Liquid Transporting and Dispensing Equipment, Trailer Mounted.

Conduct the tests defined by section 6.2.1.1 above.

6.2.1.3 Liquid Transporting & Dispensing Equipment, Cargo Carrier, Full-Tracked, Mounted

Conduct the tests defined by Section 6.2.1.1 above.

6.2.1.4 Transporter, Liquid, Towed

6.2.1.4.1 Static Evaluation -

The tests of this evaluation require little or no test item mobility; however, a prime mover of the specified type shall be provided.

a. Electrical equipment

Determine the suitability of the following test item electrical features:

- 1) Stop and taillights.
- 2) Blackout lights.
- 3) Compatibility of electrical connections.

b. Towing hitch

- 1) Apply a tensile load of 20,000 pounds at the front and rear drawbar coupling attachments
- 2) Record the following:
  - a) Magnitude of load applied.
  - b) Any evidence of damage or permanent deformation.
  - c) Any discrepancies noted.

c. Weight and center of gravity determination

- 1) Determine the weight and the vertical and horizontal center of gravity by utilization of procedure of MTP 2-2-800.
- 2) Compute the imposed load on the lunette and axles using the net weight and payload.

d. Lifting attachments

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- 1) Subject each lifting attachment to a 24,000 pound pull in the direction of lift by a suitable lifting and measuring device.
- 2) Record the following:
  - a) Magnitude of load applied.
  - b) Any evidence of damage or permanent deformation.
  - c) Any difficulties encountered.

#### 6.2.1.4.2 Dynamic Evaluation -

##### a. Parking Brakes

- 1) The transporter with wheel cells at maximum load shall be parked on descending and ascending slopes as specified.
- 2) Set hand parking brakes and remove towing vehicle.
- 3) Check for wheel slippage and/or satisfactory operation of the mechanical parking brake.

##### b. Service Brakes

Evaluate the capability of the transporter to meet minimum performance requirements. Proceed as follows:

- 1) Operate the prime mover and transporter on a dry, level concrete or asphalt surface at a speed of 20 miles per hours, the transporter shall be fully equipped and loaded with 455 gallons of water,  $\pm$  5 gallons, in each fuel cell wheel.
- 2) When specified speed is reached, apply the service brakes.
- 3) Measure the distance between the point of brake application and point of stoppage. Distance shall not exceed 30 feet or as specified.
- 4) A combination of the prime mover and transporter brakes may be utilized.
- 5) Perform above test 10 times in each direction; determine average stopping distance.
- 6) Note and record the following:
  - a) Total weight, prime mover and transporter.
  - b) Vehicle speed attained.
  - c) Distance measured in 3) above.
  - d) Brake system(s) used (prime mover or transporter or both)
  - e) Brake system air pressure.
  - f) Any difficulties encountered.
  - g) Any unusual noises and/or vibrations.
  - h) Any faults or malfunctions noted.

##### c. Interaction with towing vehicle.

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Evaluate the degree to which the test item is compatible with the specified towing vehicle while performing a series of basic maneuvers. Proceed as follows:

- 1) Operate the test item/towing vehicle along a straight path over a level, straight section of improved roadway for approximately five miles for each of the following conditions:
  - a) Test item loaded to rated capacity.
  - b) Vehicle combination speed varied between 10 miles per hour and maximum safe speed.
  - c) Record the following:
    1. Total weight.
    2. Vehicle speed.
    3. Test item does or does not track the towing vehicle. Amount of weave from side to side of towing vehicle straight line path.
    4. Lateral swaying tendency which adversely affects the controllability of the vehicle combination.
- 2) Operate the test item/towing vehicle on ascending or descending longitudinal grades up to 30 percent and side slopes up to 20 percent, or as otherwise specified, at speeds consistent with safety for each of the following conditions:
  - a) Test item loaded to rated capacity.
  - b) Record the following:
    1. Tendency of test item to slip.
    2. Tendency of vehicle combination to become unstable.
    3. Any unusual noises and/or vibrations.
- 3) With transporter coupled to the prime mover, operate the prime mover through its minimum turning circle to the right and to the left. Record the following:
  - a) Tendency of test item to slip during the turn.
  - b) Any damage to towed trailer or prime mover.
  - c) Any interference between the transporter and prime mover.
- 4) Operate transporter coupled to a prime mover on a level terrain through a series of backing operations.
  - a) Operator to be instructed in the operation of reverse driving techniques to avoid "jackknifing"
  - b) Record the following:
    1. Tendency of vehicle combination to become unstable.
    2. Any unusual noises or vibrations.
    3. Any interference or damage while backing through minimum turning circle to the right and to the left.

d. Fording

Evaluate the test item when being towed through fresh or salt water, including the residual and cumulative effects of submergence on the

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performance of test item components by performing the applicable procedures of MTP 2-2-520, MTP 2-2-612 and the following:

- 1) With the test item coupled to a prime mover, negotiate fresh and salt water obstacles. The following conditions shall apply:
  - a) Load test item to rated capacity.
  - b) Test item time in water shall be for a minimum of 15 minutes.
  - c) Water depth shall be great enough to entirely submerge the test item chassis.
  - d) Perform the test a total of five times.
- 2) Record the following:
  - a) Water content of samples for oil taken from hydraulic master cylinder (if applicable).
  - b) Effect(s) of water immersion on brake performance.
  - c) Damage or unsuitable water contamination to any test
  - d) Any discrepancies noted.

e. Road Test

Conduct the tests defined by section 6.2.1.1b, above.

6.2.1.4.3 Performance Test -

a. Wheel Filling

- 1) Fill each wheel to capacity with water using the filling and emptying system consisting of a fuel transfer pump, fuel hoses and nozzle, and filter/separator, when required.
- 2) Operate the filling system at the maximum flow rate possible with pressure inside the wheels not exceeding 5 pounds per square inch during the filling operation.
- 3) Adjust the pressure to 3 pounds per square inch and hold for a 30 minute period.
- 4) Increase the pressure to 15 pounds per square inch and hold for 30 minutes.
- 5) Observe the wheels and filling components for leakage.

b. Liquid Capacity

- 1) Prior to emptying the fuel cell wheels, the transporter shall be weighed with the wheels filled to capacity with water at an inflation pressure of 10 PSI.
- 2) Divide the liquid weight by the weight of 1 gallon of water (8.345 pounds) to determine the liquid capacity in gallons.

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c. Wheel Emptying

- 1) Empty the wheels at the maximum flow rate possible without exceeding 15 PSI wheel pressure.
- 2) Air shall be the pressurizing medium.
- 3) Observe the wheels and related components for leakage.

d. Record the following:

- 1) Flow rate, gallons per minute, filling and emptying.
- 2) Any indication of leakage to wheels or components.
- 3) Capacity of fuel cell wheels in gallons.
- 4) Any unusual noise or vibration.
- 5) Adequacy of filling and emptying system.
- 6) Any difficulties encountered.

6.2.2

Compatibility

The compatibility characteristics of the test item shall be evaluated concurrently with accomplishment of other testing and evaluation as noted by this document.

a. Consideration shall be given to the following potential interface problem areas.

- 1) Assembly of components.
- 2) Test item ability to accommodate material being transported.
- 3) Test item use with other MN specified materiel.
- 4) Test item transport and handling.

b. Indicate by narrative description actual dimensions, sketches, and/or photographic coverage any compatibility difficulties encountered.

6.2.3

Environmental Effects Evaluation

The purpose of these tests is to determine the ability of the test item and its various components and accessories to resist physical damage and/or deterioration when subjected to accelerated climatic and environmental conditions. Testing should be conducted as necessary to ensure that the test item is capable of operating satisfactorily under conditions existing within the operating areas and/or environments as specified by the applicable MN and as defined by AR 70-38. In the preparation for conduct of testing, test personnel should consult the applicable portions of MIL-STD-810.

6.2.3.1

Salt Spray Test

a. A salt spray test in accordance with MIL-STD-810, Method 509, shall be conducted on sample type test item components and accessories.

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b. Following completion of the test, inspect each item for corrosion and/or wear. Record the following:

- 1) Item or component under evaluation.
- 2) Description of results.

6.2.3.2 Tropic Environment Evaluation

Accomplish the applicable procedures of MTP 9-4-003.

Record data.

6.2.3.3 Desert Environmental Evaluation

Subject the test item to the applicable procedures of MTP 9-4-001. Record the appropriate data.

6.2.3.4 Arctic Environmental Evaluation

Subject the test item to the applicable procedures of MTP 9-4-005. Record the appropriate data.

6.2.3.5 Fungus Resistance

All appropriate test item type components and accessories shall be subjected to the applicable procedures of MTP 4-2-818.

6.2.3.6 Explosive Atmosphere Test

Subject the test item as applicable to the explosive atmosphere test described in Method 511 of MIL-STD-810. This will ensure the safe operation of test items when used with the more volatile fuels such as aviation gasoline.

6.2.3.7 Fuel Resistance Test

a. All materials which normally come into contact with fuel and which may be a source of fuel contamination shall be exposed to test fuel for a minimum period of 100 hours at a temperature of  $77^{\circ} \pm 5^{\circ}\text{F}$ .

b. Following completion of test, inspect each item for evidence of swelling, corrosion, separation or dissolving or other deformations. Record the following:

- 1) Item or component under evaluation.
- 2) Description of results.
- 3) Effects of the tank on the fuel.

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6.2.3.8      **Climatic Tests**

Subject the test item to representative climate conditions as defined by AR 70-38 and as specified by the applicable MN. Use the following procedures and applicable tests as contained in MIL-STD-810. Record data.

6.2.3.8.1    **Low Temperature Test -**

Evaluate the test item under conditions of low temperature not to exceed limits as established by the applicable MN and as defined by AR 70-38. Accomplish low temperature testing in accordance with MIL-STD-810, Method 502.

6.2.3.8.2    **High Temperature Test -**

Evaluate the test item under conditions of high temperature not to exceed limits established by the applicable MN and as defined by AR 70-38. Accomplish high temperature testing in accordance with MIL-STD-810, Method 501.

6.2.3.8.3    **Rain Test -**

Subject the test item to a rain test in accordance with the applicable procedures of MIL-STD-810, Method 506.

6.2.3.8.4    **Dust Test -**

Subject the test item to a dust test in accordance with the applicable procedures of MIL-STD-810, Method 510.

6.2.4        **Electromagnetic Interference**

Subject the test item to appropriate procedures of MTP 2-2-613 and applicable requirements of MIL-STD-461, MIL-STD-462, and MIL-STD-463.

6.2.5        **Durability**

The durability of the test item shall be verified by performing the applicable procedures of MTP 9-2-503 and the following:

a. During accomplishment of testing as described by this document, the durability characteristics of the test item shall be observed. In the event of equipment failure during testing, maintenance and repair procedures shall be accomplished and the testing shall be continued.

b. Upon completion of all testing as described in this document, the test item shall be inspected for signs of excessive or accelerated wear and potential equipment failure.

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c. Record test data as required by MTP 9-2-503 and any indication of the following:

- 1) Fastening failure.
- 2) Loose or missing hardware.
- 3) Excessive wear.
- 4) Warping and/or distortion.
- 5) Damage to any component, material or finish.

6.2.6 Transportability

Evaluate the transportability characteristics of the test item.

NOTE: Personnel should be familiar with the applicable portions of the following documents:

- 1) MIL-STD-129 Marking for Shipment and Storage.
- 2) MIL-STD-209 Slinging Eyes and Attachments for Lifting and Tying Down Military Equipment.
- 3) MIL-STD-1186 Cushioning, Anchoring, Bracing, Blocking, and Waterproofing: Appropriate Test Methods.

a. The draft technical manual shall be reviewed or consulted for proper procedures for tying down, lifting, and transporting the item by various media. Any inadequacy of instructions should be reported by EPR.

b. Evaluate the transportability characteristics of the test item by accomplishing the applicable procedures of MTP 10-2-503. Record the test data.

c. Evaluate the effectiveness of tiedown/securing devices and lifting attachments using MIL-STD-209 as a basis for the evaluation.

6.2.7 Maintenance Evaluation

a. Evaluate and appraise the maintenance factors of the test item as described in MTP 10-2-507 and AMC Pamphlet 706-134 with emphasis on the following:

- 1) Organizational (O), Direct Support (F), and General Support (H) maintenance requirements.
- 2) Operator through General Support Maintenance literature.
- 3) Repair parts.
- 4) Tools.
- 5) Test and handling equipment.
- 6) Maintenance facilities.

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- 7) Personnel skill requirements.
- 8) Maintainability.
- 9) Availability.

b. Calculate those indicators which express the effects of the preceding aspects.

6.2.8        Safety

Evaluate the safety characteristics and features of the test item in accordance with the applicable procedures in MIP 10-2-508.

NOTES: 1. Provide a safety recommendation in accordance with USATECOM Regulation 385-6, and the test directive, as applicable.

2. During the conduct of all tests, test personnel shall observe the proper safety precautions and, in particular, shall adhere closely to the draft technical manual for the handling and use of the test item.
3. The procedures for all tests shall be examined, and any condition which might constitute a safety hazard shall be recorded and reported.

Perform the following:

a. Examine the safety characteristics of the test item, including the procedures for its operation and its design to ensure that maximum safety has been provided consistent with military requirements. Hazards shall be classified as safe, marginal, critical, and catastrophic. Consider the following:

- 1) Observe all safety precautions associated with safe driving speeds.
- 2) After fording test, verify operation of brake system, check for proper lubrication as required in operating instructions.
- 3) Verify proper tire pressures.
- 4) Observe all safety precautions associated with pressurized vessels.
- 5) Ensure all fuels, propellants, etc. are properly protected and handling procedures observed as per TM 10-1101, Chapter 15.

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- 6) Verify all equipment, such as pumps, tanks for vehicles and storage, used in transfer operations are properly bonded and grounded.
- 7) Ensure all spills are cleaned up immediately.
- 8) Ensure suitable containers are placed as needed under hose connections, faucets, and similar locations to collect any leakage.
- 9) Avoid prolonged exposure to fuel vapors by personnel.
- 10) Gloves and other required protective clothing should be worn to prevent fuels from contacting the skin.
- 11) Examine operating procedures in the light that improperly executed or misinterpreted instructions could result in bodily harm or equipment damage.
- 12) Where unsafe conditions cannot be avoided, ensure that the test item is properly and conspicuously marked for the condition.
- 13) Indicate whether or not environmental limitations are noted explicitly.

b. Prepare a list of all test item safety features and/or devices; indicate the type of feature, its purpose, and the suitability and adequacy of the feature.

c. For each device listed, a minimum of 2 cycles of operation will be caused by simulating the type failure which the device is to detect or otherwise utilizing the feature. Record the following:

- 1) The device/feature tested.
- 2) Failure which the device is to detect or prevent.
- 3) Proper operation of the device or failure detected.

d. Prepare a listing of all warning plates, instructions and markings. Record the location and adequacy of each item listed.

e. Test personnel shall record any worthwhile comments or suggestions relative to improvement of safety features, safety measures, and/or precautions.

6.2.9        Human Factors Evaluation

Refer to MTP 10-2-505.

6.2.10      Value Analysis

a. During the conduct of all tests, test personnel shall evaluate the test item from a value versus cost standpoint. Record all pertinent comments concerning features or components which can be eliminated or modified to accomplish cost reduction without impairment of performance, reliability, quality, maintainability, or safety. The applicable portions of USATECOM Regulation 700-1 shall be used for this evaluation.

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b. Consideration shall be given to the topics listed below.  
Record comments for each topic.

- 1) Mission Capacity - The test item should be capable of accomplishing the specified task with only a reasonable margin of excess capability. Excess capacity and unused capability normally results in unnecessary bulk, excessive weight and unwarranted costs.
- 2) Simplicity - Unnecessarily complex components and systems, redundancy, and the use of unneeded parts will increase costs and maintenance efforts.
- 3) State of the Art - In many instances the use of recently developed, currently available, components and automated features will result in an overall product improvement and cost savings.
- 4) Standardization - The use of identical parts and parts currently in the military system will reduce the overall logistics burden.

6.2.11      Quality Assurance

Throughout all tests, examine the test item for compliance with the quality requirements of the applicable MN and the provisions of MTP 10-2-511.

6.2.12      Reliability

Refer to MTP 10-2-512

6.3            TEST DATA

NOTE: In compiling the Test Data section, test personnel should expound upon those data procedures which are other than quantitative in nature by recording narrative descriptions which will provide full details of conditions and/or events occurring during the conduct of the test.

6.3.1          Preparation for Test

6.3.1.1        Initial Inspection

Record data required by MTP 10-2-500

6.3.1.2        Inventory Check

List any materials missing from the BIIL.

6.3.1.3        Physical Characteristics

Record the data required by MTP 10-2-500 and as follows:

- a. Manufacturer and model, type/class.

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- 1) Tanks.
  - 2) Pump and power unit.
  - 3) Filter/separator.
  - 4) Manifold.
  - 5) Hose reels.
  - 6) Ground reel.
  - 7) Metering unit.
  - 8) Hose and fittings.
  - 9) Nozzles.
  - 10) Valves.
  - 11) Tiedown Equipment.
  - 12) Grounding rods.
  - 13) Fuel tanks.
- b. Safety equipment supplied.
- c. Weight and overall dimensions of test item(s).
- d. Tiedowns, number and location.

6.3.1.4      Operator Training and Familiarization

Record the data required by MTP 10-2-501.

6.3.1.5      Preoperational Inspection, Assembly, and Functional Check

6.3.1.5.1      Inspection and Assembly -

Record the following:

- a. Any damage or defects observed. (Describe in detail).
- b. Adequacy and completeness of accessories and tools necessary for their installation.
- c. Satisfactory operation of all controls and moving parts.
- d. Adequacy of instructional material, instructional plates, name plates, and warning patches.
- e. Overall suitability of the test item for testing.

6.3.1.5.2      Operational Check and Functional Verification -

Record the following:

- a. Any condition of excessive noise and/or vibration.
- b. Satisfactory operation.

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c. Adequacy of draft technical manual(s) and other instructional material.

d. Any fault, failure, malfunction, or discrepancy noted.

e. Suitability of the test item for testing.

6.3.2 Test Conduct

6.3.2.1 Operational Performance

Record all items required to be noted while conducting tests defined in Section 6.2.1.

6.3.2.2 Compatibility

Record by description, dimensions, sketches, and/or photographic coverage any compatibility difficulties encountered.

6.3.2.3 Environmental Effects Evaluation

6.3.2.3.1 Salt Spray Test -

Record data as required by Section 6.2.3.1

6.3.2.3.2 Tropic Environment Evaluation -

Record data as required by MTP 9-4-003.

6.3.2.3.3 Desert Environmental Evaluation -

Record test data as required by MTP 9-4-001.

6.3.2.3.4 Arctic Environmental Evaluation -

Record test data as required by MTP 9-4-005.

6.3.2.3.5 Fungus Resistance Test -

Record data as required by MTP 4-2-818.

6.3.2.3.6 Explosive Atmosphere Test -

Record data as required by MIL-STD-810, Method 511.

6.3.2.3.7 Fuel Resistance Test -

Record data as required by Section 6.2.3.7

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6.3.2.3.8 **Climatic Tests -**

Record data as required by MIL-STD-810.

6.3.2.5 **Durability**

Record data as required by MTP 9-2-503

6.3.2.6 **Transportability**

Record data as required by MTP 10-2-503.

6.3.2.7 **Maintenance Evaluation**

Record data as required by MTP 10-2-507

6.3.2.8 **Safety**

Record appropriate data as required by MTP 10-2-508

6.3.2.9 **Human Factors Evaluation**

Record the data required by MTP 10-2-505.

6.3.2.10 **Value Analysis**

a. Record comments for each of the topics listed below:

- 1) Mission Capacity
- 2) Simplicity
- 3) State of the Art
- 4) Standardization
- 5) Materials and Methods of Construction
- 6) Clearances

b. When making recommendations for changes in test item features or components, record the following:

- 1) The feature of component under consideration.
- 2) Recommended change(s).
- 3) Reason(s) for recommended change(s).

6.3.2.11 **Quality Assurance**

Record:

a. Data required by MTP 10-2-511.

b. Comments as to any design shortcomings in the area of required quality.

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6.3.2.12 Reliability

Record the data as required by MTP 10-2-512

6.4 DATA REDUCTION AND PRESENTATION

a. Data obtained during the conduct of the test will be summarized, making use of photographs and charts as appropriate. All photographs and charts will be properly identified and labeled. Test data will be obtained for each liquid transporting and dispensing equipment unit tested, then summarized and evaluated as required.

b. Data obtained for each performance characteristics will be compared with established technical performance characteristics as specified in MN or other developmental criteria. Test data obtained from different types of liquid transporting and dispensing equipment units undergoing the same test will be compared. Where performance is repeated after a specific test or repair, the data obtained will be compared with the previously obtained data, and where definite differences occur, the conditions that caused the differences and the degree of difference will be summarized along with appropriate comments of the test personnel.

c. A Safety Evaluation, based on the data of paragraph 6.3.2.8 shall be presented in accordance with USATECOM Regulation 385-6.

d. The presentation shall conclude with a summarization of the suitability of the test item for service testing.